DESIGN OF ENCAPSULATION STRATEGIES FOR THE INSERTION OF SELF-HEALING AGENTS IN THERMOSETS

Catheline A. L. Colard[1], Xander K. D. Hillewaere[1], Alexandre V. Beirão[2], Patrice Vandendaele[3], Karin Eufinger[3] and Filip E. Du Prez[1]

[1]Ghent University, Polymer Chemistry Research Group, Department of Organic Chemistry, 281 S4 Krijgslaan, Ghent. B-9000. Belgium.
Email: catheline.colard@ugent.be, filip.duprez@ugent.be

[2]Devan Micropolis S.A.
2650 Rua Eng. Frederico Ulrich, Parque da Ciencia e Tecnologia, Moreira Da Maia. 4470 605. Portugal
Email: alexandre.beirao@micropolis.pt

[3]Devan Chemicals NV
18 Klein Frankrijk, Ronse. B-9600. Belgium
Email: patrice.vandendaele@devan.net

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ABSTRACT

A Strategic Innovative Materials (SIM) project, supported by the Agency for Innovation through Science and Technology (IWT), for the development of self-healing materials has been set off in Flanders.

This part of the project aims at encapsulating newly developed self-healing agents. Microcapsules represent reservoirs of healing agents which are dispersed into materials. Matrixes such as thermoset materials undergo damages over time due to external forces such as cyclic stresses and climate conditions. This can eventually lead to the formation of cracks, thereby deteriorating and weakening the materials. Upon crack formation, the microcapsules present in the matrix should break (and not debond) and release their reactive liquid content, allowing the material to recover its strength. The development of engineered self-healing material has gained strong interests over the last decade and few reviews amongst an expanding literature resource are already available [1-3].

Different synthetic routes for the formation of core-shell structures, well-known in the literature [4], are applied and adapted to our targeted systems. Emulsification of the active agent into an immiscible phase is realised upon mechanical stirring and shell formation is performed typically by polycondensation of a prepolymer onto the surface droplet [5] or interfacial polymerisation of A and B monomers present separately in one of the liquid phase [6].

Procedures being optimised within our group will be presented. Important criteria of the final encapsulated components before their integration into materials, which are discussed, are for instance: the chemical compatibility between the shell and the encapsulated agents, the shell strength and surface properties and the size and concentration of the microcapsules. The compatibility of the procedures with industrial processes towards safety and scaling-up are also addressed.

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